



Are Radiological Examinations Necessary for Mentally Handicapped Dental Patients?

Mental Retarde Hastalarda Radyolojik Inceleme Gerekli Midir?

Radiological Examination of Mentally Handicapped Dental Patients

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Özet

Amaç: Bu çalışmanın amacı, zihinsel engelli veya uyum sağlanamayan hastalarda radyolojik muayene gerekliliğinin sedasyon altında elde edilen tomografik görüntülerle değerlendirilmesidir. **Gereç ve Yöntem:** Çalışmaya toplam 98 mental retarde veya uyum sağlanamayan hasta dahil edilmiştir. Hastaların radyolojik muayenesi konik ışınli dental tomografi (KIDT) ile elde edilen görüntüler üzerinde yapılmış, sonuçlar ağız içi muayene sonucunda elde edilen verilerle ve tedavi sonuçları ile karşılaştırılmıştır. **Bulgular:** Pediatrik hastalarda radyolojik ve ağız içi muayene %43,8 oranında uyumlu bulunurken, bu oran yetişkin hastalarda %48 dir. Pediatrik hastalarda radyolojik muayene ile tedavi sonuçlarının uyum oranı %41,9 iken, ağız içi muayene ile tedavi sonuçları %93,3 uyumlu bulunmuştur. Yetişkin hastalarda radyolojik muayene ile tedavi sonuçlarının uyum oranı %53, ağız içi muayene ile tedavi sonuçlarının uyum oranı %91,8 dir. **Tartışma:** Bu çalışmanın sonuçlarına göre zihinsel engelli hastalarda radyolojik muayene tek başına yeterli olmadığı, ancak ağız içi muayeneye destek amacıyla kullanılabilceği anlaşılmıştır. Hastaların birden fazla kez genel anestezi almasını engellemek ve gerekli olan tüm tedavilerin tek bir sefer yapılmasını sağlamak ancak tam bir muayene ile mümkündür. Bu hasta grubunda radyolojik muayene ancak sedasyon altında elde edilen KIBT görüntüleme ile mümkündür. Zihinsel engelli bireylere en iyi hizmeti ancak bünyesinde KIBT, anestezi uzmanı, eğitilmiş personel ve işlem sonrası bakım ünitesi bulunan kliniklerde sunulabilir. Ülkemizde bu kliniklerin sayısının artması gerekmektedir.

Anahtar Kelimeler

Zihinsel Engelli; Sedasyon; Konik Işınli Dental Tomografi

Abstract

Aim: The purpose of this study was to evaluate the necessity of radiological examinations of mentally handicapped (MHP) or uncooperative patients (UCP) with computed tomographic images obtained under intravenous sedation. **Material and Method:** A total of 98 MHPs or UCPs are included in this study. Radiological images were obtained with cone beam dental tomography (CBCT) under sedation anesthesia. Radiological and oral examinations were compared with each other and also with treatment results. **Results:** Radiological and oral indications of pediatric patients were 43.8% compatible, compared to 48% in adults. Radiological examination was 41.9% compatible with treatment results, while oral examination was 93.3% compatible in pediatric patients. In adult patients, radiological examination was 53% compatible with treatment results, while oral examination was 91.8% compatible. **Discussion:** Radiological examination alone is insufficient in treatment planning for MHPs/UCPs, but it does support the oral examination. Nevertheless, to avoid patients receiving general anesthesia more than once, CBCT imaging under sedation anesthesia seems to be the best method of radiological examination. For this purpose, to provide the best care to these patients, the number of dental clinics that have CBCT, an anesthesiologist, and a post-operative care unit and trained crew should be increased.

Keywords

Cone Beam Dental Tomography; Mentally Handicapped; Sedation Anesthesia

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Introduction

Dental radiography has become an indispensable part of routine dental examination with the technological development of radiological devices. Dental radiology helps the dental practitioner in assessing or examining the patient for the detection of dental caries or periapical lesions, for imaging prior to dental implant surgery, for defining symptomatic or asymptomatic oral pathology, or for the creation of 3D reconstruction of the maxillofacial region with cone beam dental tomography (CBCT) [1]. Despite the advantages of dental radiology, mentally handicapped patients (MHP) and uncooperative patients (UCP) cannot benefit from this diagnostic tool. It is impossible to perform panoramic radiography (OPG) on MHP/UCPs because it is mandatory to avoid movement for up to 20 seconds. Also, it is hard to establish cooperation while taking periapical (PA) or bite-wing (BW) dental radiography on MHP/UCPs, as it requires immobility of the patient and a second hand—usually the hand of the dentist or technician—for the stabilization of the radiograph in the patient's mouth.

Hood et al. reported that dentists and the dental team in the southeastern part of the USA avoid taking radiographs of MHP/UCPs because of the fear of radiation exposure [2].

Cone beam computed tomography (CBCT) is newer technology than computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET).

Today, CBCT is commonly used for the diagnosis of pathology of the maxillofacial region, evaluation of anatomical structures prior to implant placement, traumatic injuries of the orofacial region, and temporomandibular joint disorders [3].

The radiation dose of the CBCT devices depends on the device model and imaging technique, but it is 4-77 times higher than panoramic radiography. However, it is 51%-96% lower than conventional CT [3, 4].

Also, the "gantry" part of CBCT devices can be placed in the supine position, which enables immobilization of the sedated patient in a horizontal position.

Sedation is the temporary suppression of consciousness that varies from light to deep and generally is used when there is a need for immobilization or reduction of anxiety [5].

Medical procedures like dental treatment and medical imaging (MRI, CT, OPG, etc.) that require cooperation are usually hard to apply to MHP/UCPs. In such cases, procedural sedation is a safe and helpful method to achieve the intended immobilization [5].

The purpose of this study was to evaluate the necessity of radiological examination of MHP/UCPs before dental treatment under general anesthesia.

Material and Method

This study was performed between March 2012 and March 2014 with approval of the Human Ethical Committee of Erciyes University. A total of 98 patients were included in this study.

MHP/UCPs for whom oral and radiological examinations could not be performed in any circumstances by the Department of Oral Diagnosis and Radiology were referred to the Department of Oral and Maxillofacial Surgery. Study design was explained to the patients' parents, and patients were enrolled in this study with the permission of their parents or legal guardians.

Inclusion Criteria

- 1) MHP/UCPs for whom clinical and radiological examination could not be performed or only clinical, but not radiological, examination could be performed
 - 2) MHP/UCPs with systemic parameters suitable for IV sedation
 - 3) MHP/UCPs for whom the informed consent form was signed by the legal guardian or parents
 - 4) MHP/UCPs for whom the quality of tomographic images were sufficient for radiological examination
- Patients who did not meet these criteria were excluded from the study.

CBCT imaging

Before CBCT imaging, all patients underwent systemic examination for IV sedation by two anesthetists.

With the approval of the anesthetists, patients were referred to the CBCT room. Patients were placed on the gantry of the CBCT device (NewTom 5G, FP, Quantitative Radiology, Verona, Italy) in a horizontal position, and oxygen was administered (2lt/min) via nasal cannula. Patients were monitored for SpO₂ and heart rate. Propofol (PropofolLupiro 1%, B.Braun Melsungen AG, Melsungen, Germany) 2-3 mg/kg IV was injected, and when consciousness was lost, patients were covered with a lead cover. CBCT imaging was started, and the patients were observed during the procedure from the control room.

After CBCT imaging, patients remained on the gantry until they regained consciousness. Patients were followed for 2 hours post-procedure and discharged from the hospital without any complications.

Image Processing

All CBCT images of the patients were processed and OPGs were created with an image program (NNT Software V3.00; NewTom; Italy) (Figure 1-2).



Figure 1. OPG of a pediatric patient that was obtained from raw CBCT image.



Figure 2. OPG of an adult patient that was obtained from raw CBCT image.

Data Collection

All patients underwent general anesthesia for the dental treatment. Before treatment, the practitioner did the radiological examination first and noted the findings/indications, and then oral examination was done and findings/indications were noted. Once data collection was completed, treatments of all patients were done under general anesthesia.

Oral and radiological findings/indications were compared with each other and were also compared with treatment results to determine the necessity of the radiological examination of the MHP/UCPs.

Results

A total of 50 pediatric (<15 years old) and 48 adult (>15 years old) patients were enrolled in this study.

Pediatric Patients

Mean age was 9.42 years (min. 2 – max. 15 years); 33 (66.6%) were male and 17 (33.4%) were female.

A total of 544 teeth were evaluated in oral and radiological examinations. Oral and radiological indications were compatible in 237 (43.8%) teeth, while 307 (56.2%) indications were not. Incompatible indications were divided into three subgroups: 1) teeth that were only indicated in radiological examination (94 teeth, 17.2%); 2) teeth that were only indicated in oral examination (152 teeth, 27.8%); and 3) teeth that were indicated in oral and radiological examination, but with different indications (61 teeth, 11.1%).

Compatible indications were listed as conservative treatment for 61 teeth, tooth extraction for 166 teeth, and root canal treatment for 10 teeth.

Radiological and oral examinations were compared with treatment results. In 228 (41.9%) teeth, radiological and oral examinations were compatible and also compatible with treatment results. Oral examination alone was 93.3% compatible (420/450) with treatment results, while radiological examination was 41.9% (228/544) compatible with treatment results.

Adult Patients

Mean age was 23.7 years (min. 16 – max. 47 years); 24 (50%) were male and 24 (50%) were female.

A total of 489 teeth were evaluated in oral and radiological examinations. Oral and radiological indications were compatible in 235 (48%) teeth, while 254 (52%) indications were not. Incompatible indications were divided into three subgroups: 1) teeth that were only indicated in radiological examination (107 teeth, 21.8%); 2) teeth that were only indicated in oral examination (116 teeth, 23.7%); and 3) teeth that were indicated in oral and radiological examination but with different indications (31 teeth, 6.3%).

Compatible indications were listed as conservative treatment for 111 teeth and tooth extraction for 124 teeth.

Radiological and oral examinations were also compared with treatment results. In 254 (53.0%) teeth, radiological and oral examinations were compatible and were also compatible with treatment results. Oral examination alone was 91.8% compatible (360/392) with treatment results, while radiological examination was 51.9% (254/489) compatible with treatment results.

Discussion

Patient cooperation is the main factor in ensuring and maintaining oral health. However, due to lack of cooperation, MHP/UCPs are at high risk for poor oral and dental health [1].

Aşıcı et al. showed that MHPs have more teeth erosions and decay/missing/filling teeth (DMFT) scores when compared with healthy patients [6]. Additionally, MHPs have higher odontogenic infection risk when compared with healthy individuals due to inadequate oral hygiene and immunosuppression [7].

A survey of the literature showed that investigations on MHPs generally focused on periodontal problems, DMFT index, and orthodontic anomalies [7,8]. Anders and Davis reviewed 27 studies that compared the oral health of adults with mental disabilities with the normal population and showed poor oral hygiene and a higher prevalence and severity of periodontal disease [8].

Although MHPs have higher odontogenic infection risk and have poorer oral hygiene than the healthy population, there is only one radiological study on MHPs in the literature. Farman et al. performed a study on 72 MHPs with periapical radiographs. They found one or more dental anomaly in 90% of patients and granuloma or cyst in 32% of patients, and reported that 60% of the patients' treatment plans were changed due to radiological findings. Only one patient was discharged from the study due to lack of cooperation [1].

In our study, all patients were uncooperative patients on whom we were unable to obtain PA or OPG. It may be possible that the levels of the mental disability of these two studies were different.

Farman et al. concluded that dental examination of MHPs cannot be done properly without radiological assessment, and they also proved the necessity of radiological assessment of MHPs [1].

However, it can be difficult to obtain OPG or PA from MHPs due to lack of cooperation, immobilization, and difficulty in remaining standing for up to 20 secs. Also, Hood et al. reported that dentists and the dental team in the southeastern part of the USA avoid taking radiographs from MHP/UCPs because of the fear of radiation exposure [2].

Sedation seems to be the best way to achieve immobilization. However, patients must be in the supine position. CBCT devices with a "gantry" part allow for obtaining radiological images of MHPs that remain in the supine position. Also, there is no need for cooperation from sedated patients.

CBCT enables the image to be obtained more quickly and at a lower dose of radiation [9]. In addition, with the help of software, raw images can be processed on various planes (sagittal, axial, or coronal) and can also be used to obtain 2D images like OPG [10].

The radiation dose of CBCT devices varies from 52 to 1025 microsieverts (μSv) based on the imaging protocol and the specifications of the device, an amount that equals a 4 to 77 times greater radiation dose than that of an OPG [11].

In this study, images were obtained with NewTom 5G CBCT. This device has the "ALARA" (As Low As Reasonably Achieved) principle that provides exposure of the patient to the lowest radiation dose and the minimum exposure time. Images were obtained at the minimum dose of radiation (52 μSv) that CBCT

allows, and this level of radiation equals the radiation dose of four OPG.

In a year, approximately four or more control or follow-up OPGs are taken of patients before and after a cyst/tumor enucleation or dental implant surgery. Given this situation, a single exposure of MHPs to CBCT radiation at the time of each treatment, performed under general anesthesia, can be considered to be not harmful.

Occlusal or enamel caries could be overlooked due to superposition on radiological evaluation of the patients, and related teeth could be evaluated as healthy. In this study, the majority of the radiologically undiagnosed teeth (69 of the 152 teeth in pediatric patients, 58 of the 116 teeth in adult patients) were occlusal caries. The authors believe that this situation explains one reason for the difference between oral and radiological examinations.

There are different factors such as patient age, periodontal health of the tooth, number of the remnant teeth, etc. that affect the prognosis and survival of a tooth. Also, radiological indication can be modified after oral examination due to the factors mentioned above. In this study, a total of 65 teeth were indicated as needing root canal treatment or filling on radiological examination, but 47 of them were extracted based on oral examination. This is considered a difference between oral and radiological examinations.

In this study, when obtaining OPGs from raw images, maxilla and mandible were processed simultaneously. But the curved shape of the anterior maxilla causes distortion during the processing of the raw images. It is understood that this type of image processing led to the differences between oral and radiological examination in the anterior maxilla. In order to reduce distortion, separate image processing of the maxilla and mandible is recommended.

Although all CBCT imaging was performed under sedation anesthesia, the swallowing reflex of the patients cannot be inhibited completely. This leads to image distortion and can be considered another reason for the difference between oral and radiological examinations.

Radiological and oral examinations were also compared with treatment results. In pediatric patients, radiological examination was 41.9% compatible with treatment results, while oral examination was 93.3% compatible. In adult patients, radiological examination was 53.0% compatible with treatment results, while oral examination was 91.8%.

In the light of these results, radiological examination alone is insufficient in treatment planning of MHPs/UCPs, but it does support the oral examination, as expected.

Conclusions;

1) As Farman et al. stated that radiological examination must be done in the most convenient way for MHPs/UCPs. Also, it can save the patients from receiving general anesthesia more than once.

2) Oral examination is 93.3% compatible with treatment results in pediatric MHPs. It seems that all necessary treatments can be done by oral examination alone without radiological examination due to a high compliance rate. In symptomatic cases, such as swelling or the presence of an unerupted tooth, radio-

logical examination should be performed.

3) Radiological examination of MHPs/UCPs can be done in dental clinics/hospital/faculties that have CBCT, an anesthesiologist, trained staff, and a post-operative care unit. Increasing the numbers of these centers worldwide is recommended to provide the best service for these patients.

Competing interests

The authors declare that they have no competing interests.

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